MEMORANDUM

TO: Project File

MEMO NO.: WMG-038

FROM: Bill Gregg/John Craun

FILE: B690-200

SUBJECT: Hickok's Well Survey

DATE: September 21, 1983

We have reviewed the Hickok well survey for the purpose of evaluating our recommendations on multi-aquifer wells. Specifically, Table 5-7 from our report (copy attached) was used to develop a rough cost estimate for multi-aquifer well remedial actions based on the information provided by the Hickok survey.

Information Gaps

The first item in Table 5-7 is to fill information gaps in Hickok's survey. Information that is critical for an effective remedial program for multi-aquifer wells includes obtaining well construction data on at leat two wells that may connect other aquifers with the Mt. Simon aquifer, and on twelve other wells that may connect other aquifers with the Prairie du Chien aquifer. The two deep wells are:

MN unique no. 232727 - 800 ft. deep owned by M.B. Green, and
MN unique no. 216104 (W107) - 755 ft. deep, Interior Elevator Co.

Information that we have is that Interior Elevator Company had two wells, one 700 ft. deep and one 970 ft. deep. The existence and condition of these wells should be determined. The twelve other possible multi-aquifer wells identified by Hickok are:

203609	232534
206495	232614
232565	232682
232576	232706
232630	232973
232525	232975

The twelve possible multi-aquifer wells are located as shown in Figure 1. Three additional wells listed by Hickok, which would be possible multi-aquifer wells (216088, 216083, and 216087), were listed as sealed by Hult and Schoenberg (1981).

The well construction for each of these wells needs to be determined. The Hickok survey indicates that these wells penetrate the Prairie du Chien or Jordan formations or that they may be sufficiently deep to do so. The wells should be geophysicalkly logged to determine whether or not they are multi-aquifer wells and whether inter-aquifer flow is occurring.

Another area where more information is needed is for the 18 multi-aquifer wells that were identified by the Hickok survey., Table 1 is a list of these wells and their locations are shown in Figure 2. All of the multi-aquifer wells identified by Hickok connect the basal St. Peter with the Prairie du Chien. It is not known whether inter-aquifer flow occurs in these wells, and if so, whether or not any contaminants in the St. Peter aquifer could migrate into the basal section, and thus be carried down to the Prairie du Chien. Geophysical logging and water quality sampling should provide the necessary data to fill the information gaps for these wells.

The cost estimate for item one in Table 5-7 of our report is $25,000 to $50,000. We think this remains as a good estimate for the work to fill information gaps in the Hickok survey.

Items 2 and 3 on Table 5-7 are unaffected by the results of the Hickok survey.

Mt. Simon-Hinckley Multi-Aquifer Wells

Item 4 of Table 5-7 is affected by the results of Hickok's survey in that no new multi-aquifer wells with a connection to the Mt. Simon-Hinckley aquifer were found. If further information on wells 232727 and 216104 (as described earlier) indicates that these wells need to be sealed or reconstructed, then the cost would be $30,000 to $60,000 using the cost basis of Table 5-7. Before any remedial work at 232727 would be done, consideration must be given as to whether or not the Prairie du Chien is contaminated at this location. Well 232727 is probably far enough east to be unaffected by any contamination from the site (see Figure 1).

Item 5 was addressed in the earlier discussion of whether or not the multi-aquifer wells identified by Hickok actually transmit contaminants from the basal St. Peter to the Prairie du Chien. Additionally, evaluating ground-water monitoring data and performing simplified modeling should help determine the need for remedial actions for these wells.

Prairie du Chien-Jordan Multi-Aquifer Wells

Item 6 in Table 5-7 recommends reconstructing or sealing the multi-aquifer wells that lead to the Prairie du Chien-Jordan if it is shown that it would be cost-effective. As stated above, Hickok's survey found 18 such wells, all connected with the basal St. Peter. From Figure 2 it is clear that many of these wells are outside the zone of suspected contamination in the St. Peter. At the very most, only seven wells - W45, W46, W48, W49, W62, W66, and SLP7 - are close enough to be affected by any contamination. Hult and Schoenburg (1981) list W66 as "reported filled", so it may not require any further work. In addition, W62 and SLP7 are far enough north that action within the next few decades should not be necessary - if ever. The cost basis for these wells in Table 5-7 is $15,000 to $30,000 per well which is probably too high if the wells are to be reconstructed. Depending upon the water needs of the user, a liner could be inserted to seal off the basal St.

Peter, or the Prairie du Chien could be grouted shut. These reconstruction activities would cost much less than $15,000; a cost of about $5,000-per well or a total cost of $20,000 seems more reasonable to reconstruct the four wells in the general area of historic ground-water contamination identified by Hickok that connect the basal St. Peter with the Prairie du Chien.

St. Peter Multi-Aquifer Wells

Item 6 of Table 5-7 also calls for sealing or reconstructing multi-aquifer wells that lead to the St. Peter if this is cost-effective. Hickok's survey identified 26 such wells in St. Louis Park, as shown in Figure 3. An additional 16 St. Peter multi-aquifer wells in Edina and Hopkins are not included in this analysis because of their distance from the site. From Figure 3 it is clear that ony 5 to 8 of these wells are east or southeast of the site and therefore might require remedy, and 3 are probably too far away to require immediate action (nos. 216089, 200538 and 232643). If all of the remaining 5 wells were sealed, the cost would be $25,000 to $50,000, using the cost basis of Table 5-7.

MPCA High Priority Wells

In its 1982 Superfund request, the MPCA identified nine high priority multi-aquifer wells for abandonment, five extending to the Prairie du Chien (W35, W40, W45, W46, and W62) and four to the St. Peter or basal St. Peter (W29, W41, W44 and W75). Our review of Hickok's survey resulted in three of the Prairie du Chien wells (W45, W46 and W62) and two St. Peter wells (W44 and W75) being identified, leaving two wells in each category unaccounted for.

Cost Implications

Table 2 summarizes the implications of this review of Hickok's well survey on the extent and costs of multi-aquifer well remedial actions. Comparision with Table 5-7 from our report (copy attached) shows that the revised estimate of Table 2 generally falls in the lower half of our original estimate. This reflects the smaller number of multi-aquifer wells actually discovered compared to our worst case assumptions. Because of the more rapid transport of two-ring PAH in the shallow aquifers (Drift-Platteville and St. Peter) than we originally assumed (see J. Craun's memo of September 21), the future work items and expenditures will probably be required every 25 years or so and not as infrequently as every 50 years. This puts our total present value cost estimate for multi-aquifer well remedial action in the range of $0.1 to $0.6 million, compared to our original estimate of $0.1 to $0.9 million, plus up to $0.7 million in contingency actions (which are now included in our $0.1 to $0.6 million cost estimate) (Tables 7-1 and 7-2 of our report).

It should be noted that the cost estimates in Table 2 are based on reconstructuring wells so they can still be used or sealing them and replacing the user's water supply with city water. No costs are included for drilling new wells, since this extra expense would be avoided if possible.

TABLE 5-7

ESTIMATED COSTS OF RECOMMENDED

REMEDIAL ACTIONS FOR OFF-SITE MULTI-AQUIFER WELLS

Recommended Remedial Action	Current Expenditures	Fixed Expenditures (made every 25 to 50 years)
1. Fill Information Gaps in Hickok's Recent Multi-aquifer Well Survey	$25,000 - $50,000	Not Applicable
2. Repeat Multi-aquifer Well Inventory for Shallow Aquifer as Contaminants Migrate	Not Applicable	$25,000 - $100,000
3. Expand Inventory of Multi-aquifer Wells Connecting the Prairie du Chien-Jordan to the Mt. Simon-Hinckley	$20,000 - $50,000	$20,000 - $50,000
4. Seal or Reconstruct Multi-aquifer Wells which Connect:		
• Shallow Aquifers to the Mt. Simon-Hinckley	$0 - $300,000(a)	$0 - $300,000(a)
• Prairie du Chien-Jordan to the Mt. Simon-Hinckley	$0 - $150,000(b)	$0 - $150,000(b)
5. Assess the Significance of Multi-aquifer Wells Identified in Item 6	$25,000(e)	$25,000(e)
6. If Shown to be Cost-Effective as a Result of Item 5 - Seal or Reconstruct Multi-aquifer Wells which Connect:		
• Drift-Platteville to the St. Peter	$0 - $200,000(c)	$0 - $200,000(c)
• Drift-Platteville and/or St. Peter to the Prairie du Chien-Jordan	$0 - $300,000(d)	$0 - $300,000(d)

Total Present Value Cost		Every 25 Years	Every 50 Years
• Without Item 6	$70,000 - $575,000	$30,000 - $260,000	$6,000 - $60,000
• With Item 6	$70,000 - $1,075,000	$30,000 - $470,000	$6,000 - $105,000

Notes

(a) Based on zero to ten wells being sealed at a cost of $15,000 to $30,000 per well (see Table 5-6).
(b) Based on zero to five wells being sealed at a cost of $15,000 to $30,000 per well (see Table 5-6).
(c) Based on zero to twenty wells being sealed at a cost of $5,000 to $10,000 per well (see Table 5-6).
(d) Based on zero to ten wells sealed at a cost of $15,000 to $30,000 per well (see Table 5-6).
(e) Study costs for evaluating ground-water monitoring data and for performing simplified ground-water modeling.

TABLE 1

MULTI-AQUIFER WELLS IDENTIFIED BY HICKOK SURVEY

MN Unique Well No.	NON-RESPONSIVE	Log	Casing
114302		107-272 Osp 272-280 Opc	0-246 4" csg
200544		201-244 Osp 244-277 Opc	4" csg 0-232
201057		170-233 Osp 233-236 Opc	5" csg 0-192
201062		78-243 Osp 243-303 Opc	8" csg 0-194
201063		94-250 Osp 250-292 Opc	5" csg 0-223
201065		92-167 Osp 167-168 Opc	8" csg 0-98
206419		72-201 Osp 201-290 Opc	6" csg 53-177
206429		100-266 Osp 266-270 Opc	4" csg 0-220
206430		101-270 Osp 270-271 Opc.	4" 0-223
206436 SLP 7		100-260 Osp 260-380 Opc	20" 0-247
206438 W62		105-274 Osp 274-394 Opc	10" 90-246
206445 W45		122-265 Osp 265-312 Opc	6" 0-244
206450 W49		96-260 Osp 260-381 Opc	6" 0-241
206487		188-250 Osp 250-253 Opc	4" 0-27
206489		224-256 Osp 256-284 Opc	4" 0-225
216065 W46		122-265 Osp 265-312 Opc	6" 0-234

TABLE 1 (continued)

MN Unique Well No.	Location	Log	Casing
216067 W48	NON-RESPONSIVE	94-257 Osp 257-377 Opc	20" 0-255
216081 W66	Camb. & M'haha.Cr.	87-251 Osp 251-280 Opc	6" 0-212

TABLE 2

REVISED ESTIMATE OF COSTS FOR
MULTI-AQUIFER WELL REMEDIAL ACTIONS

(thousands of dollars)

Item No. (see Table 5-7 for explanation)	Current Expenditures	Future Expenditures (Once every 25 years)
1	25-50	NA
2	NA[a]	25-100
3	20-50	20-50
4	0-60[b]	0-150[c]
5	25	25
6	0-150	0-250[e]
	70-335	30-240

Notes:

(a) NA = not applicable.

(b) Based on 0 to 2 wells requiring action (see page 2), at a cost of $15,000 to $30,000 per well.

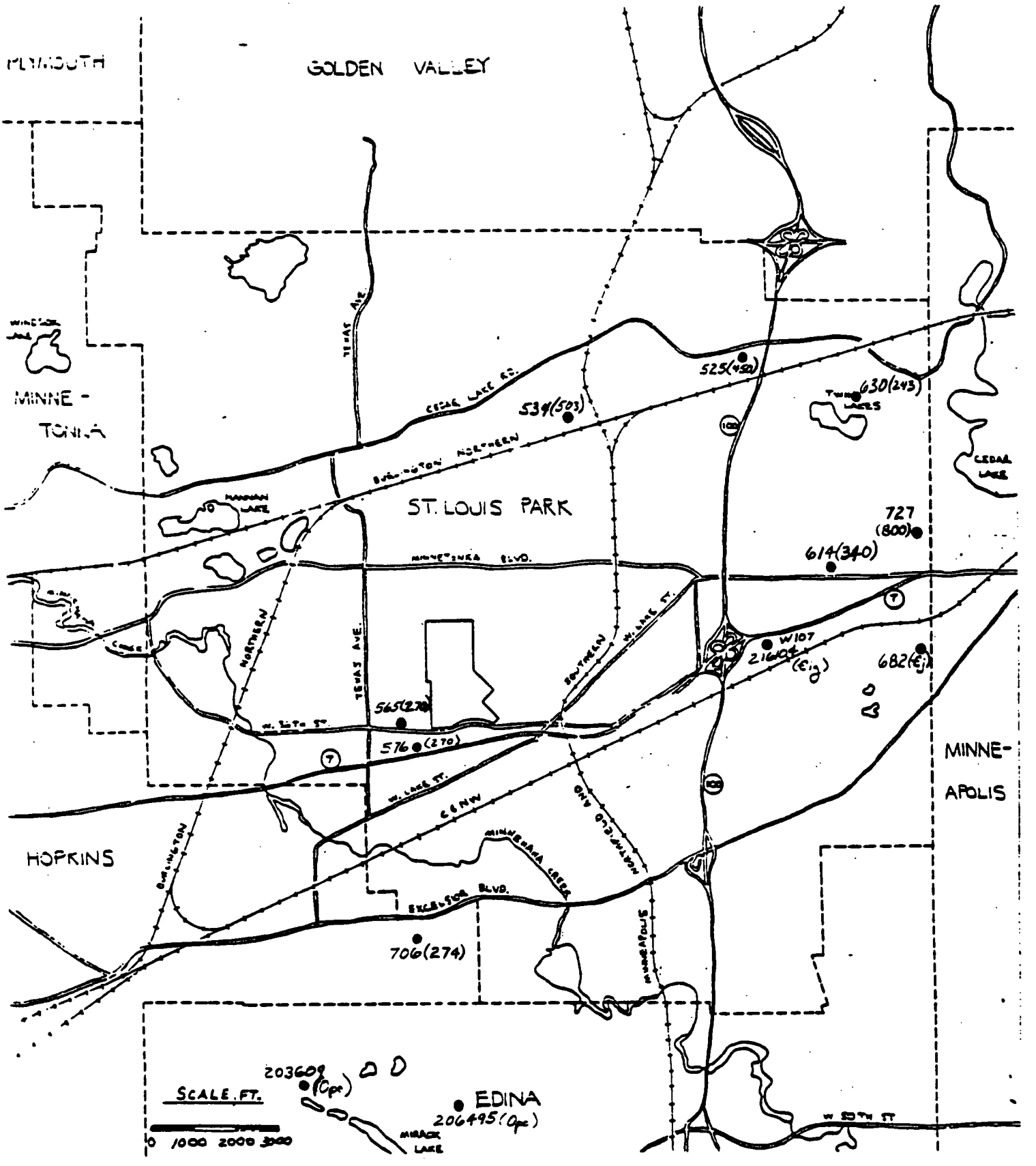
(c) Based on 0 to 5 wells requiring action at $15,000 to $30,000 each. This number of wells is lower than the original estimate of 0 to 15 wells based on projecting the results of Hickok's well survey.

(d) Based on up to 4 wells requiring action at $5,000 each (see page 3) plus 2 additional wells identified by the MPCA at up to $30,000 each (see page 3), for wells leading to the Prairie du Chien, and for up to 7 wells leading to the St. Peter (see page 3) at up to $10,000 each.

(e) Based on 0-10 St. Peter wells at $5,000 to $10,000 each and 0-5 Prairie du Chien wells at $15,000 to $30,000 each. These numbers of wells are lower than our original estimates (see Table 5-7) based on the results of Hickok's well survey.

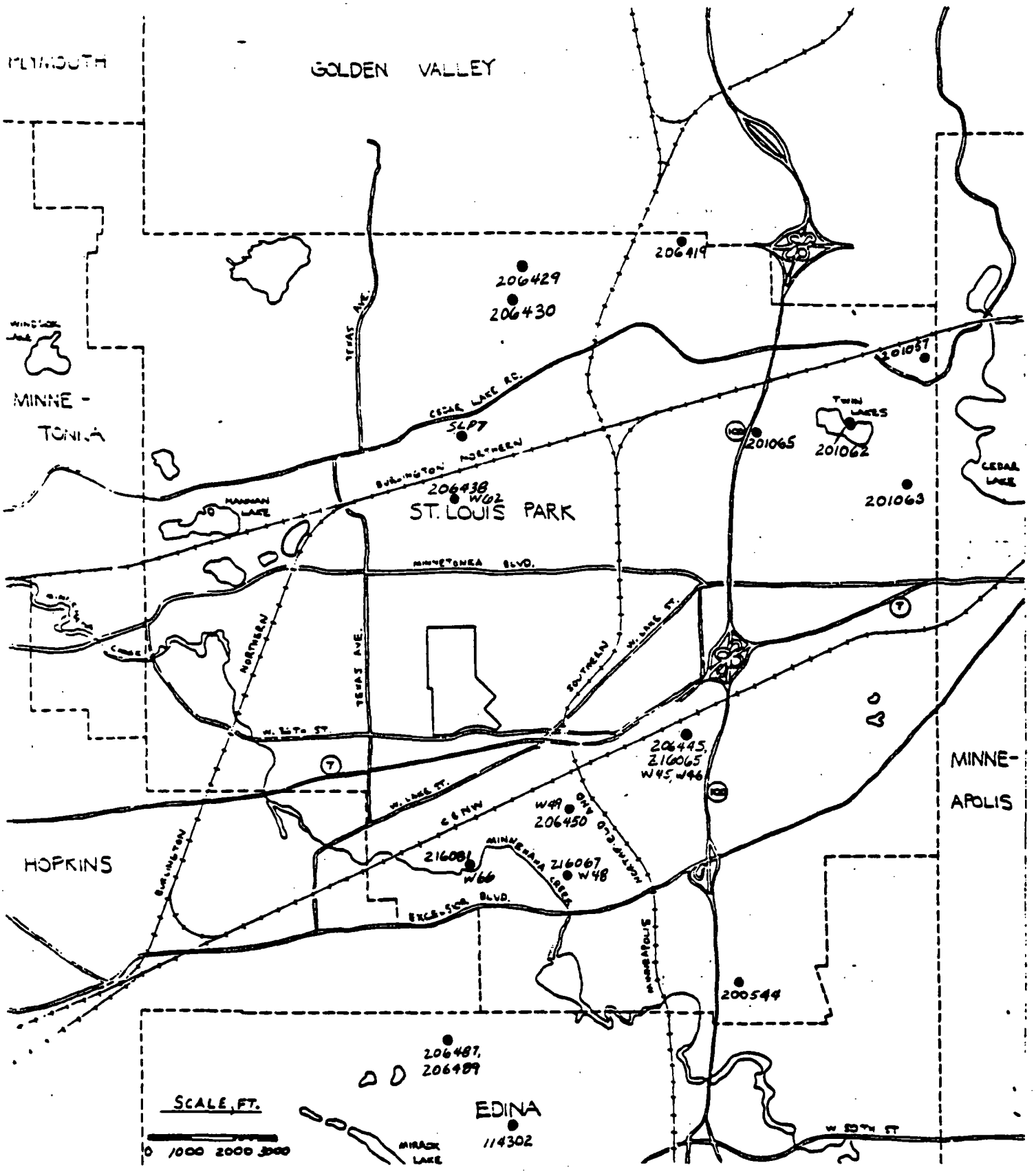
FIGURE 1. POSSIBLE MULTI-AQUIFER WELLS

(Log and/or Casing Schedule Not Known)



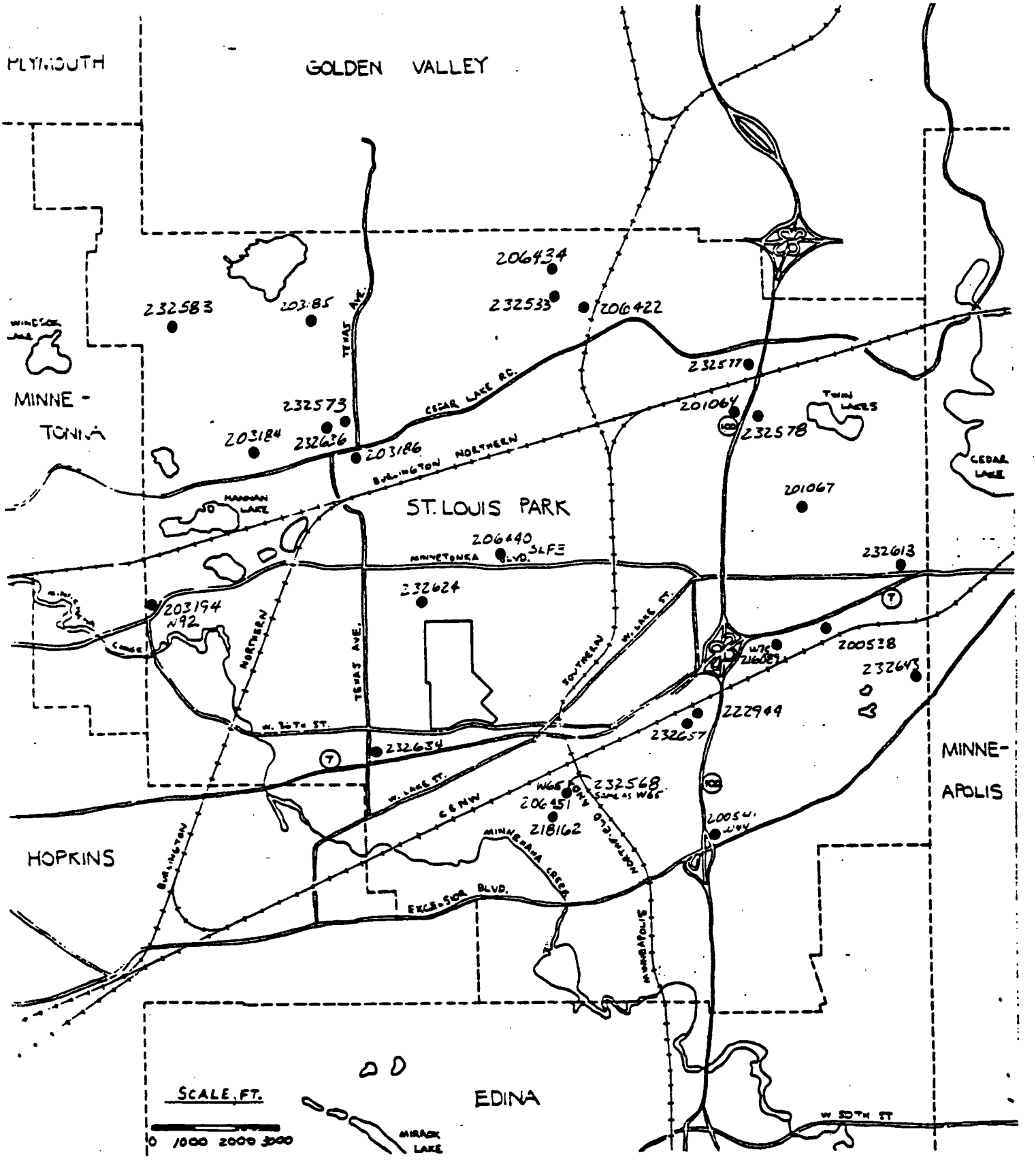
Note: All numbers preceeded by 232 unless marked otherwise (depth or aquifer if reported)

FIGURE 2. PRAIRIE DU CHIEN MULTI-AQUIFER WELLS IDENTIFIED BY HICKOK'S SURVEY



Note: All wells connect the basal St. Peter with the Praire du Chien

FIGURE 3. ST. PETER MULTI-AQUIFER WELLS IDENTIFIED BY HICKOK'S SURVEY



Note: All wells connect the Drift-Plateville with the St. Peter.